

PATENT CLAIMS

1. A power generation plant having at least one gas turbine cycle with heat-recovery boiler (4) and at least one steam turbine cycle operated via the heat-recovery boiler (4), the gas turbine cycle being designed to be semi-closed and essentially free of emissions and essentially comprising a compressor (1), a combustion chamber (2) arranged downstream of the compressor (1), a gas turbine (3) arranged downstream of the combustion chamber (2), a heat-recovery boiler (4) arranged downstream of the gas turbine (3), and at least one generator (8) coupled to the gas turbine (3), characterized in that first means (12) are arranged which alternatively or additionally allow hot gas to be fed into the hot-gas path (23) between gas turbine (3) and heat-recovery boiler (4), and in that second means (15) are arranged which alternatively or additionally allow exhaust gas to be expelled from the exhaust-gas path (40) downstream of the heat-recovery boiler (4).

2. The power generation plant as claimed in claim 1, characterized in that the first and second means (12, 15) are switch-over members which allow the feeding-in or expelling in particular by resetting air flaps.

3. The power generation plant as claimed in either of the preceding claims, characterized in that the additional hot gas, to be alternatively or additionally fed into the hot-gas path (23), is provided by one or more auxiliary burners (13) which are preferably supplied with fresh air (34) via a blower (14).

4. The power generation plant as claimed in one of the preceding claims, characterized in that a CO<sub>2</sub>/H<sub>2</sub>O gas turbine cycle is involved in which CO<sub>2</sub> and H<sub>2</sub>O produced, via corresponding means for compression (6) and/or means for cooling (7), are removed from the gas turbine cycle, in particular preferably in such a way

as to branch off directly downstream of the compressor (1), and in particular in a liquid and/or supercritical form, and in that the gas turbine cycle is supplied with largely pure oxygen in particular via an air separation plant (9).  
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5. The power generation plant as claimed in claim 4, characterized in that the air separation plant (9) is a cryogenic plant or a plant based on a diaphragm  
10 process.

6. The power generation plant as claimed in one of the preceding claims, characterized in that the steam turbine cycle is of essentially closed design and has  
15 at least one steam turbine (10, 19) and at least one generator (11) coupled thereto, and in that the steam turbine cycle, with the use solely of hot gas fed in via the first means, while gas is simultaneously expelled via the second means, can be operated in such  
20 a way that the generator (11) generates sufficient energy in order to put the gas turbine plant (1-3) and an air separation plant (9) possibly present into operation, or respectively in order to serve as emergency generating unit in the event of a failure of  
25 the gas turbine plant (1-3).

7. The power generation plant as claimed in claim 6, characterized in that, for starting up the gas turbine, a further switch-over member (17), via which ambient  
30 air (39) can be drawn in, is arranged upstream of the compressor (1).

8. The power generation plant as claimed in one of the preceding claims, characterized in that the steam  
35 turbine arranged in the steam turbine cycle is a bottoming steam turbine (10).

9. The power generation plant as claimed in one of the preceding claims, characterized in that the steam

turbine cycle comprises a topping steam turbine (19), the partly expanded exhaust steam of which, after injection into the cycle medium upstream of, in and/or downstream of the combustion chamber (2), is expanded  
5 to ambient pressure in the gas turbine (3), with power being delivered, in particular a switch-over member (18) being provided with which the exhaust steam can be directed past the gas turbine directly for liquefaction into a cooler (5) arranged in the gas turbine cycle.

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10. A method of starting up a power generation plant as claimed in one of claims 1 to 9, characterized in that, first of all, in a first phase, the steam turbine cycle is put into operation with hot gas fed in via the first means (12), while at the same time the exhaust gases are at least partly expelled via the second means (15), then, in a second phase, the generator (8) of the gas turbine cycle is motor-driven with current by a generator (11) arranged in the steam turbine cycle in order to start up the turboset (1, 3), the compressor (1), via an air flap (17) arranged upstream and/or via the second means (15) opened in both directions, drawing in fresh air or a combustion-gas mixture and delivering it through the combustion chamber (2), in which, possibly with additional feeding of largely pure oxygen, fuel is fired, so that the turbine (3) starts to assist the motor-driven generator (8) and finally serves as sole drive, the hot exhaust gases of the gas turbine (3) progressively taking over the steam generation in the heat-recovery boiler (4) and completely taking over the steam generation in the heat-recovery boiler (4) at the end.

35 11. A method of starting up a power generation plant as claimed in one of claims 1 to 9, characterized in that, first of all, in a first phase, the steam turbine cycle is put into operation with hot gas fed in via the first means (12), while at the same time the exhaust gases are at least partly expelled via the second means

(15), in that, after the turboset (1-3, 8), operated with air as substitute medium via an air flap (17) arranged upstream of the compressor (1), is running in a self-sustaining manner, in a second phase, the gas 5 turbine cycle is closed via the first and second means (12, 15) and the air flap (17), and largely pure oxygen is fed as an oxidizing agent to the combustion chamber (3), gas being continuously expelled from the cycle in order to compensate for the feed of oxygen and fuel, 10 and the composition of the circulating gas progressively approaching an equilibrium, in which the separation and liquefaction of the combustion products can be started.

15 12. The method as claimed in claim 11, characterized in that the gas turbine cycle is a CO<sub>2</sub>/H<sub>2</sub>O gas turbine cycle, and in that the separation and liquefaction of excess carbon dioxide can be started by the carbon dioxide, in a compressor (6), being brought to the 20 pressure required for further use and being further dried and liquefied in a cooler (7).

13. The method as claimed in one of claims 10 to 12, characterized in that the current available after the 25 first phase via the generator (11) is at least partly used for operating the air separation plant (9) and thus for providing largely pure oxygen for the combustion process in the combustion chamber (2).

30 14. The method as claimed in one of claims 10 to 13, characterized in that, during or after the first phase, a large proportion of the start-up output is made available in the form of heat by means of the auxiliary burners (13).

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15. A method of operating a power generation plant as claimed in one of claims 1 to 9, characterized in that, when the gas turbine cycle is not operating, only the steam turbine cycle is operated via the feeding-in of

hot air with the first means (12) and via the expelling of exhaust gases with the second means (15), and in that the generator (11) arranged in the steam turbine cycle thus provides current in particular in the sense  
5 of an emergency generating unit.